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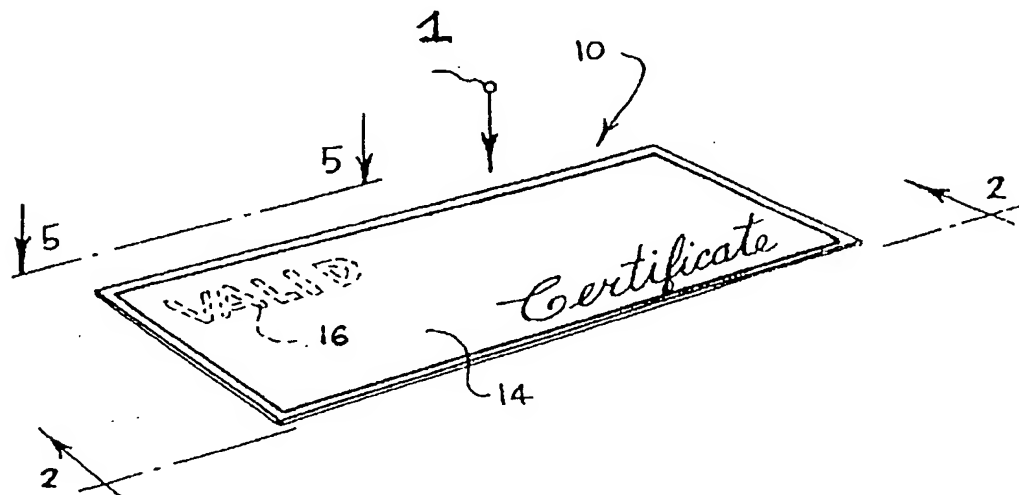
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(54) **METHODS DE PROTECTION DE DOCUMENTS EN RELIEF  
ET PRODUITS**

(54) **EMBOSSSED DOCUMENT PROTECTION METHODS AND  
PRODUCTS**



(57) Document sécuritaire comprenant au moins une série de lignes imprimées de couleur ayant un pas où une partie des lignes imprimées sont en relief. La partie en relief des lignes forme une image latente. Celle-ci est visible lorsqu'on la regarde depuis des angles non perpendiculaires par rapport au document et à l'angle de relief. L'image latente est invisible lorsqu'on regarde le document perpendiculairement par rapport au document ou lorsqu'on regarde une copie du document original.

(57) A security document has at least one set of printed lines of color having a pitch wherein a part of the printed lines are embossed. The embossed part of the lines form a latent image. The latent image is visible when viewed from non-perpendicular angles relative to the document and angle of embossment. The latent image is invisible when the document is viewed at the perpendicular angle to the document or when viewing a copy of the original document.



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## ABSTRACT

A security document has at least one set of printed lines of color having a pitch wherein a part of the printed lines are embossed. The embossed part of the lines form a latent image. The latent image is visible when viewed from non-perpendicular angles relative to the document and angle of embossment. The latent image is invisible when the document is viewed at the perpendicular angle to the document or when viewing a copy of the original document.

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## EMBOSSSED DOCUMENT PROTECTION METHODS AND PRODUCTS

### Field of the Invention

5 This invention relates generally to document protection methods and products.

### Background of the Invention

Many methods and products have been developed to deter counterfeiting of valuable documents or financial instruments such as currency. Most such documents are prepared by printing or lithography on high quality media such as silk, rice paper, and high contact rag paper, and the printing of original documents may be done either in black-and-white or in color, and if in color, either in spot color, colored backgrounds and/or multicolor printing. The common printing processes of valuable originals, whether in black and white or in color, are intaglio and gravure, among others. These and the other processes mentioned in this application are very well known in the art and will not be discussed in great detail.

15 Most of the useful examples in the prior art to deter counterfeiting and the likes are intended to provide that copies are produced either with a clear moire pattern or with a "latent image" indicia that on the original document is invisible or nearly invisible to the naked eye.

20 An example of the means to print security documents is illustrated in United States Paten Number 5,487,567 by Volpe. Volpe discloses a security paper having a desired "latent image" indicia formed by continuous lines at one angle and a background image also formed of continuous lines but at a different angle from the indicia. The indicia only becomes visible when copied.

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An example of the means to emboss a security document is illustrated in United States Patent Number 4,715,623 by Roule et al. Roule et al. disclose a document having at least two sets of embossed lines that are vertical, horizontal, or even curved and formed by an intaglio press. These embossed lines, however, do not register with or emboss a printed line of color having a pitch. Even though the document can be printed, Roule et al. fail to disclose the document having printed lines of color having a pitch or printed lines of color having a pitch that are registered by an embossment.

It has become imperative for purposes of document security and safety that further improvements in the area of document protection be found. In the past, to ensure a document was authentic with a latent image required the document be photocopied or the like to see the latent image. To avoid this photocopying requirement to authenticate a document, there is a need for an easier means to ensure authenticity of documents with a latent image.

#### Summary of the Invention

Our invention provides a solution for an easier means to ensure a document authenticity with a latent image. Our invention is a method and product for making a counterfeit resistant security document.

In one embodiment of the present invention, the document has at least one set of printed lines of color having a pitch wherein a part of the printed lines are embossed. The embossed part of the lines form a latent image. The latent image is visible when viewed from non-perpendicular angles relative to the document and angle of embossment. The latent image is invisible when the document is viewed at the perpendicular angle to the document or when viewing a copy of the original document.

In another embodiment of the present invention, the document has a first set of printed lines of color having a pitch which form a latent image and a second set of printed

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lines of color having a pitch and at an angle relative to the first set which forms a background image. The document on at least one set of lines is embossed so as to render an image of the latent image visible only when viewed from non-perpendicular angles relative to the document.

5 It is therefore an object of the invention to provide a significantly improved method for verifying original documents.

It is an object of the invention to produce paper on which valuable documents can be printed and allows for easy identification of authentic document paper.

10 These and other objects and advantages of the present invention can be determined from the following description of preferred embodiments according to the invention and the accompanying drawings and claims.

#### Brief Description of the Drawings

Figure 1 is an example of the present invention when the latent image is "invisible";

Figure 2 is a side view of Figure 1;

15 Figure 3 is a view of the document shown in Figure 1 at a predetermined angle rendering the latent image "visible";

Figure 4 is a side view of Figure 3;

Figure 5 is a cross-sectional view of Figure 1 across line 5-5;

Figure 6 is a cross-sectional view of Figure 3 across line 6-6;

20 Figure 7 is an enlarged fragmentary perspective view of Figure 5 across line 7-7;

Figure 8 is an enlarged cross-sectional view of Figure 7 across line 8-8;

Figure 9 is an alternative embodiment of Figure 5;

Figure 10 is an enlarged fragmentary perspective view of Figure 9 across line A - A;

Figure 11 is an enlarged cross-sectional view of Figure 10 across line B - B;

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Figure 12 illustrates a diagram of a present invention shown in Figures 9 - 11;

Figure 13 illustrates a diagram of an alternative embodiment of Figure 12;

Figure 14 illustrates a diagram of a second alternative embodiment of Figure 12; and

Figure 15 illustrates a diagram of a third alternative embodiment of Figure 12.

5 Key to diagram of Figures 5, 12 - 15:

solid line = printed line of color and pitch;

dotted lines = printed line of color and pitch in register with an embossed line; and

dot-dash line = embossed line.

#### Detailed Description of the Preferred Embodiments

10 In this specification, we use the words "print" and "printing," to refer to making an original counterfeit resistant security document 10 regardless of the techniques used and the words "copy" and "copying" to refer to making copies from an original whether by copier or scanner technology. In the present invention, the security document 10 has two essential elements as shown in Figure 7. The two essential elements are a set of printed lines 12 of  
15 color and pitch and a set of embossed lines 14 substantially in register with a part of the printed lines 12 to form a latent image 16.

The term "document" is used herein to refer to any type of material that has printing wherein someone or an entity requires the material contain counterfeit security elements, such as packaging, event tickets or security paper, as illustrated.

20 The term "latent image" is used herein for an indicia on an original document that is nearly invisible to the naked eye when viewed (1) from a perpendicular angle to the plane of the document 10 as shown in Figures 1 and 2, and is readily visible when the document 10 is viewed (4) at non-perpendicular angles to the plane of the document as shown in Figures 3 and 4.

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The term "embossed lines" 14 as used in this invention refers not to actual lines of print of color, but are grooved lines in the document 10 substrate in the design of a line formed when embossing occurs.

The term "line(s)" as referred to in this specification means any type of line, such as continuous, circle, straight, wavy, broken and dotted.

According to an embodiment of our invention, as shown in Figure 5, we have provided an original document 10. The document 10 has a support having a side comprising a print surface. On the print surface, the document 10 has a set of lines 12 of color and pitch. A part of the set of lines 12 is superimposed and in register with embossed lines 14 to form the latent image 16.

The latent image 16 is "VALID" in figures 1 and 3 although any letter, word or graphic indicia will work that indicates to the receiver whether document 10 is an authenticated original document. The latent image 16 is effective only when embossed lines 14 are in register with the portion of set of lines 12 that form latent image 16. The lines 12 can have a width ( $W$  as shown in Figure 8) of between about .0005 and about .015 inches, but preferably they are of uniform width between about .0015 and about .008 inches. The overall pitch or line spacing ( $P$ ) of lines 12 may be between 50 to 200 lines per inch, although the preferred range is from about 75 to about 140 lines per inch and an ideal pitch of from about 90 to about 133 lines per inch.

When seen by the naked eye, the set of lines 12 will appear to present a continuous pattern. The only requirements for the pitch spacing ( $P$ ) is that when the original document 10 is viewed (1) perpendicular the latent image 16 is "invisible" and when document 10 is copied the latent image 16 is "invisible" at all angles.

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In this embodiment of the invention as shown in Figure 7, the latent image is formed when a portion of the set of lines 12 is in register with embossed lines 14. Embossing as used in this embodiment of the present invention compresses in relief the substrate of the security document 10 to form embossed lines 14 on the portion of the set of printed lines 12 to fall within the shadows of the relief as illustrated in Figure 8. The embossing 14 may be felt on the reverse side of the original document as an alternative verification means of the originality of a document 10. This alternative verification means is sometimes not desired, thus the embossing on the reverse side of the document 10 can be suppressed by placing a plate on the reverse side of the document 10 when the document 10 is embossed.

As shown in Figure 8, the embossment 14 has a width ( $W1$ ) ranging from the width of the printed line 12 to about 20% greater than the width ( $W$ ) of the printed line 12. Preferably, the bottom of the embossment should have a width equal to the width of the part of line 12 being embossed. Moreover, the depth ( $D$ ) of the embossment 14 is equal to or greater than the width ( $W$ ) of the part of the printed line 12 being embossed. Thus, when the subject invention is viewed (4) from a non-perpendicular angle a reverse "white" image 24 of the latent image 16 appears and the embossed set of lines 22 are hidden. "White" refers to the color of the document 10 paper. A reverse "white" image 24 of the angled latent image 12 of the present invention is illustrated in Figure 6.

The set of printed lines 12 can be drawn by hand, computer formed, or composed on film or printing plates, in particular off-set printing, all known to those skilled in the art, or, as is also known, after creation converted to an electronic program or disk to transfer images direct to plate or to print using the programmer disk on any laser or other conventional output device. Although not necessary, never the less pantographs or designs can be overprinted or reversed out of the pattern as for example the cloud pattern identified earlier.



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For optimum safety, the invention can also be used in combination with other methods, such as using a visible image to produce a moire pattern as disclosed, for example in Patents 5,018,767 and 5,193,853, the latter of which discloses that the lines may be at a desired pitch deliberately selected so as to vary minutely from the pitch of the scanning trace of known copying machines and video options.

After the security document 10 has the set of lines 12 printed, the security document is placed upon a conventional embossment machine wherein the portion of the lines 12 that are to be embossed and registered with the embossed lines are matched with an embossing plate. The document 10 is embossed with a conventional embossing machine by known methods such as relief plates, commonly used in engraving printing. In an alternative embodiment of this process, the same printing machine can print and emboss simultaneously. In a third alternative embodiment of this process, the embossing occurs first and the printing is applied to the document later.

According to an alternative embodiment of our invention, as shown in Figure 9, we have provided an original document 10 printed on a substrate a first set of lines 30 of color and pitch and a second set of lines 32 of color and pitch. These two sets of lines 30, 32 are at relative angles to each other. Moreover, in this particular embodiment as shown in Figure 10, the substrate of the document 10 has embossed lines 14 in register with the first set of lines 30 to form the latent image.

The first set of lines 30 form a latent image that can be any letter, word or graphic indicia that indicates to the receiver of the document whether the document is an authenticated original. The lines 30 can have a width (W as shown in Figure 11) of between about .0005 and about .015 inches, but preferably they are of uniform width between about .0015 and about .008 inches. The overall pitch of lines spacing (P) of lines 30 may be

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between 50 to 200 lines per inch, although the preferred range is from about 75 to about 140 lines per inch and an ideal of from about 90 to about 133 lines per inch. We have also found that according to our invention the printing of the lines 30 can but need not be repeated in more than four orthogonal angles of say  $5^{\circ}$ ,  $45^{\circ}$ ,  $95^{\circ}$  and  $135^{\circ}$  relative to the vertical document axis each to enhance document protection during copying, regardless of the scanning frequency of the copying equipment or the position of the original on the copier plate.

According to our invention, the presentation of the first set of lines 30 is combined with the second set of lines 32 wherein the lines 30 highlight the latent image after the document is embossed and the lines 32 highlight the background image. As illustrated in Figures 9 and 12, the second set of lines 32 are shown at an angle of preferably between about  $10^{\circ}$  and about  $170^{\circ}$  relative to the first set of lines 30 and more specifically from about  $30^{\circ}$  to about  $120^{\circ}$  relative to the first set of lines 30.

When seen by the naked eye, the first set of lines 30 and the second set of lines 32 will appear to present a continuous pattern. Thus, the spacing (P1) between the first set of lines 30 and the second set of lines 32, as shown in Figure 11, is limited to a predetermined spacing dependent on the width of the lines. Preferably the second set of lines 32 are of the same width as the first set of lines 30 but they can vary in width relative to the first set of lines 30 up to a 1:6 ratio but most preferably between about a 1:1 ratio and about a 1:2 ratio. The pitch or line spacing (P2) between the second set of lines 32 may be different from the pitch of the first set of lines 30, as for example 133 lines per inch for the second set of lines 32 and 90 lines per inch for the first set of lines 30, but they also can be generally selected from within the same overall optical range of line pitch as the first set of lines, i.e., 50 to 200 lines per inch. The only requirements for the pitch spacing (P, P1 and P2) is that when

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the original document 10 is viewed (2) perpendicular the latent image is "invisible" and when the document 10 is copied the latent image is "invisible" at all angles. The second set of lines 32 preferably also use a variety of printing angles (up to four) in the document original, for example 5°, 45°, 90° and 135°.

5 In contrast to a reverse "white" image 24 that will appear in Figure 12, the embodiment as illustrated in Figure 13 will render the image of the latent image visible. In this embodiment, the second lines 32 are substantially in register with the embossed lines 14. The second lines 32 fall within the shadows of the embossed lines 14 when document 10 is viewed at non-perpendicular angles. Thus, the image of the latent image (the first lines 30) is visible and a reverse "white" image of the second lines 32 appear when document 10 is viewed non-perpendicular angles.

10 In other embodiments of the present invention, Figures 14 and 15 illustrate alternative embodiments of Figures 12 and 13 respectively. In Figure 14, the embossed lines 14 are substantially in register with first lines 32 and the embossed lines 14 continue across the second lines 32 at the angle of the first lines 30. The results are the same as in Figure 12 in that when the document 10 is viewed from non-perpendicular angles the latent image is a reverse "white" image.

15 In contrast to Figure 14, Figure 15 illustrates that the embossed lines 14 are substantially in register with the second lines 32 and the embossed lines continue across the first lines 30 at the angle of the second lines 32. The results are the same as in Figure 13 in that when the document 10 is viewed from a non-perpendicular angle the background image is a reverse "white" image.

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Although our invention is described by reference to specific preferred embodiments, it is clear that variations can be made or other material used without departing from the spirit of the invention as claimed.

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We claim:

1. A counterfeit resistant security document comprising:

a support having a side comprising a print surface;

5 a first set of printed lines on the print surface having a predetermined first color, pitch, line width, and line height in a defined area and which form a first image;

a second set of printed lines on the print surface forming a visible background image and having a predetermined second color, pitch line width and line height throughout the defined area and printed at an angle other than the angle of said first set of printed lines, the predetermined color, pitch and line width of each set of printed lines being such as to  
10 render said first image a latent image substantially indistinguishable from the background image to the naked eye and copiers when viewed or copied substantially at a right angle to the print surface;

a third set of lines that consist of a set of linear embossments that form grooves in said support at the print surface side and on which at least part of one of the sets  
15 of printed lines is registered and superimposed, the embossments having a predetermined pitch substantially identical to the pitch of the one set of printed lines, a predetermined width equal to or greater than the width and a depth greater than the height of the one set of printed lines, the said part of the one set of printed lines lying entirely within the grooves as to render the image of said latent image visible only when viewed from non-perpendicular  
20 angles relative to said document print surface and angle of embossment.

2. The document according to claim 1 in which the first and second sets of printed lines have a width from about .0005 inches to about .015 inches and said pitch is between 50 to 200 lines per inch.

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3. The document according to claim 1 in which the width of each embossment of the third set of lines is equal to, to about 20% greater than the width of the one set of printed lines.

4. The document according to claim 1 in which the depth of each embossment of the third set of lines is equal to or greater than the width of the one set of printed lines.

5. A method of making a counterfeit resistant document comprising the steps of:  
printing a first set of printed lines to form a first image and having a predetermined first color, pitch, line width, and line height in a [predetermined] defined area on a support having a side comprising a print surface;

printing a second set of printed lines on said print surface to form a visible background image and having a predetermined second color, pitch, line width and line height throughout the defined area and printed at an angle other than the angle of said first set of printed lines, the predetermined color, pitch, and line width of each set of printed lines being such as to render the first image a latent image that is substantially indistinguishable from the background image to the naked eye and copiers when viewed or copied substantially at a right angle to the print surface;

printing a third set of lines that consist of a set of linear embossments that form grooves in the support at the print surface side and on which at least part of one of the sets of printed lines is registered and superimposed, the embossments having a predetermined pitch substantially identical to the pitch of the one set of printed lines, a predetermined width equal to or greater than the width and a depth greater than the height of the one set of printed lines, the said part of one set of printed lines lying entirely within the grooves as to render said latent image visible only when viewed from non-perpendicular angles relative to said document print surface and angle of embossment.

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6. The document according to claim 2 in which the first and second sets of printed lines have a width from about .0015 inches to about .008 inches and said pitch is between 75 and 140 lines per inch.

7. The document according to claim 1 in which the one set of printed lines is the first set of printed lines so as to render the reverse image of said latent image visible only when viewed from a non-perpendicular angle relative to said document print surface and angle of embossment and which the second set of lines are printed at a predetermined angle relative to said first set of printed lines.

8. The document according to claim 1 in which the one set of printed lines is the second set of printed lines so as to render the image of said latent image visible only when viewed from a non-perpendicular angle relative to said document print surface and angle of embossment.

9. A counterfeit resistant security document comprising:  
a support having a side comprising a print surface;  
a first set of printed lines on the print surface having a predetermined first color, pitch, line width and line height in a defined area on said support;

a second set of lines that consist of a set of linear embossments that form grooves in said support at the print surface side and on at least a part of said first set of printed lines to form a latent image, the embossments substantially in registered with the first set of printed lines and having a predetermined pitch substantially identical to the pitch of the first set of printed lines, a predetermined width equal to or greater than the width and a depth greater than the height of the first set of printed lines, the part of the first set of printed lines lying entirely within the grooves as to render said latent image visible only

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when viewed from non-perpendicular angles relative to said document and angle of embossment.

10. The document according to claim 9 in which the first set of printed lines has a width from about .0005 inches to about .015 inches and said pitch is between 50 to 200 lines per inch.

11. The document according to claim 10 in which the first set of printed lines has a width from about .0015 inches to about .008 inches and said pitch is between 75 and 140 lines per inch.

12. The document according to claim 10 in which the width of each embossment of the second set of lines is equal to, to about 20% greater than the width of the line of the part of the first set of printed lines on which the embossment line is superimposed.

13. The document according to claim 9 in which the depth of each embossment of the second set of lines is at least equal to or greater than the width of the line of the part of the first set of printed lines on which the embossment line is superimposed.

14. A method of making a counterfeit resistant document comprising the steps of:  
printing at least a first set of printed lines having a predetermined pitch and line width and line height in a defined area on a support having a side comprising a print surface;

printing a second set of lines that consist of a set of linear embossments that form grooves in said support at the print surface side and on which at least a part of said first set of printed lines is registered and superimposed to form a latent image, the embossment having a predetermined pitch substantially identical to the pitch of the part of the first set of printed lines, a predetermined width equal to or greater than the width and a depth greater than the height of the part of the first set of printed lines the part of the first set



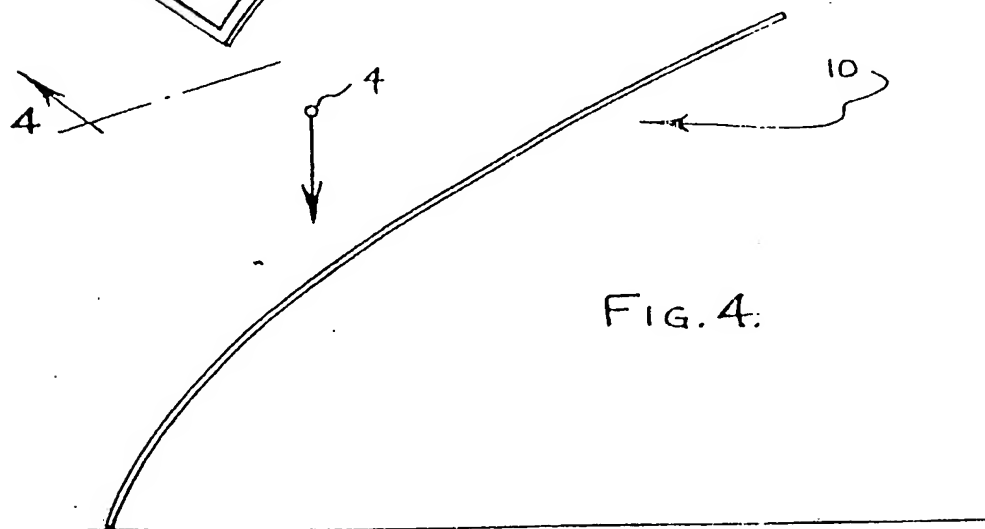
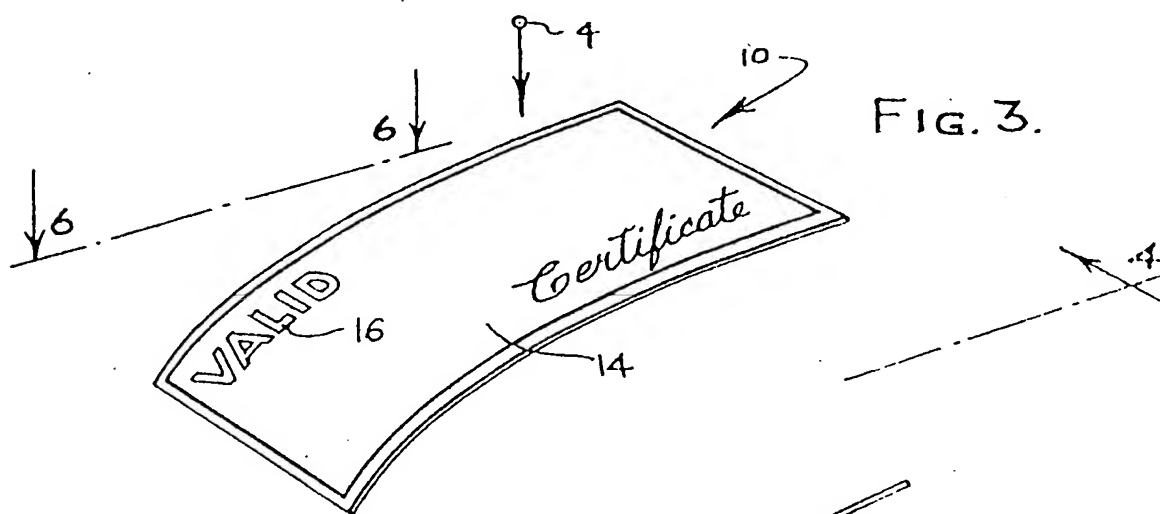
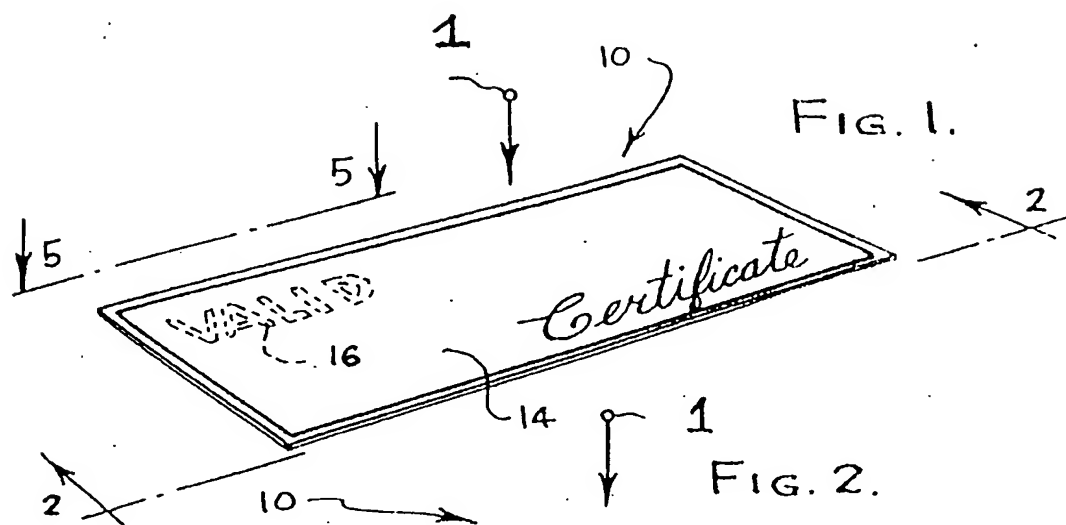
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of printed lines lying entirely within the grooves as to render said latent image visible only when viewed from non-perpendicular angles relative to said document print surface and angle of embossment.

15. A method according to claim 14 wherein the printing of said first set of  
5 printed lines and said second set of lines occurs simultaneously.

16. A method according to claim 14 wherein the printing of said first set of printed lines occurs first and said second set of lines later.

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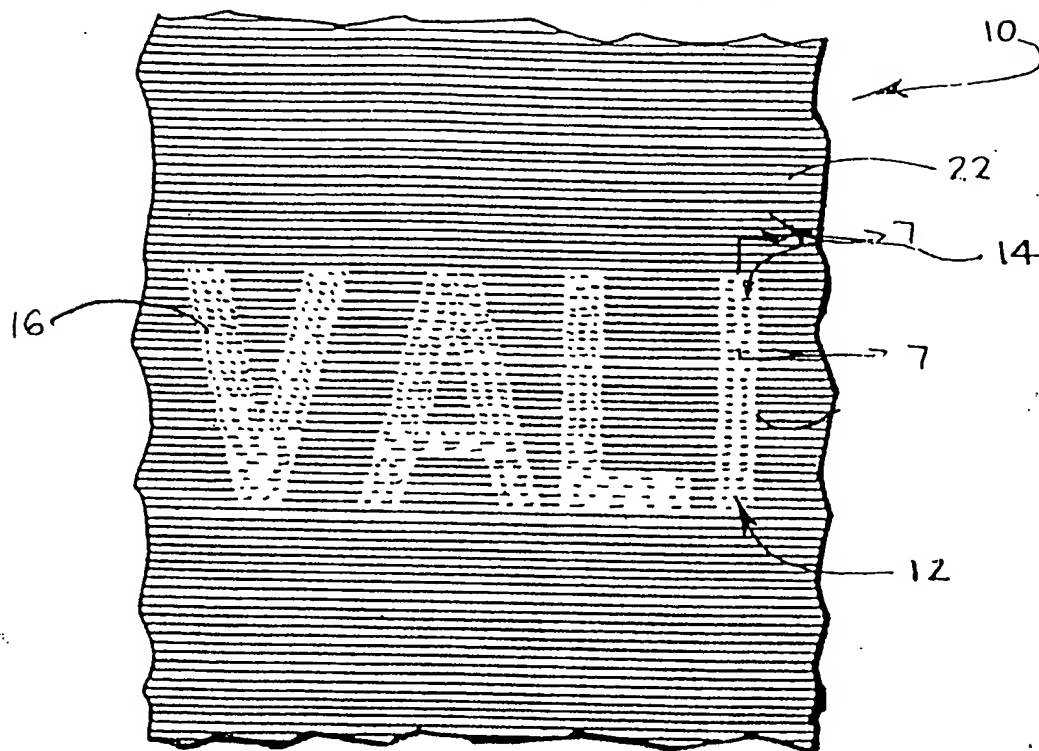


FIG. 5.

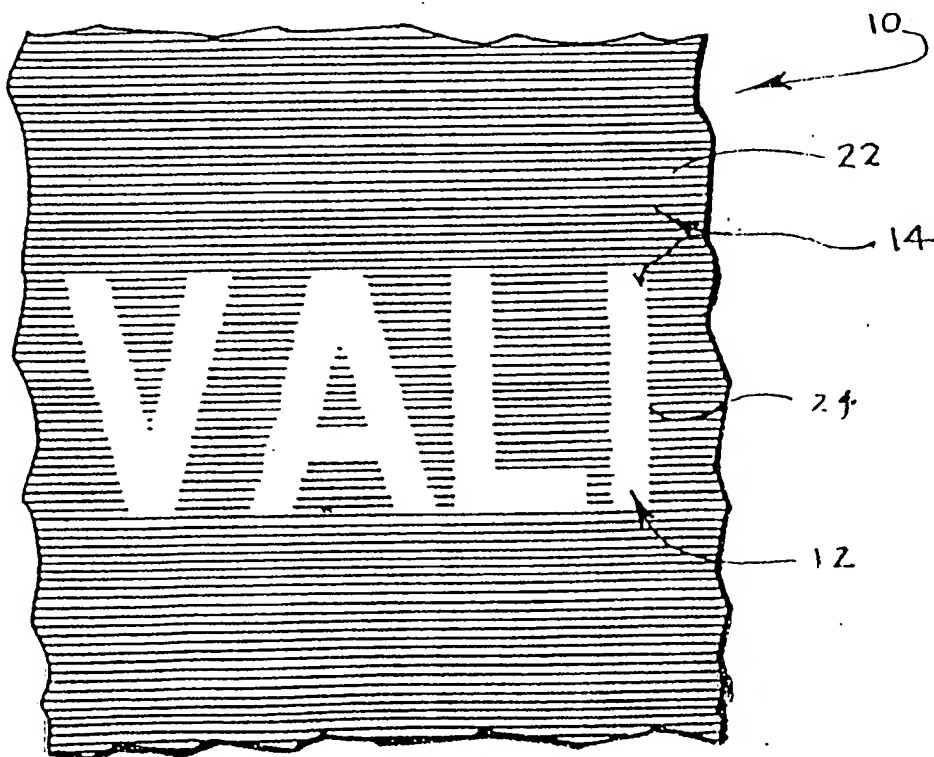


FIG. 6.

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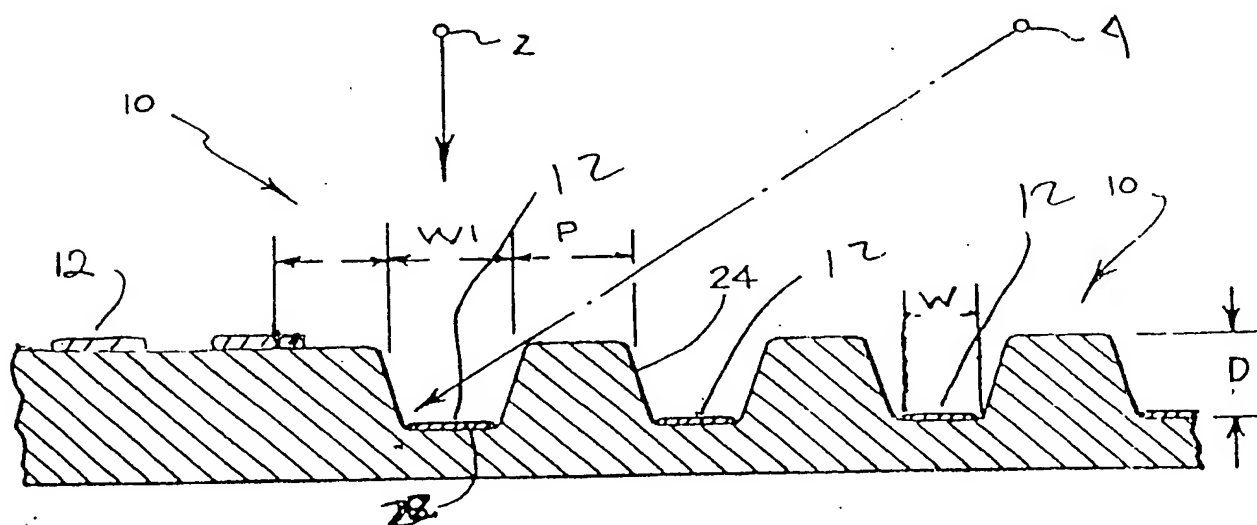
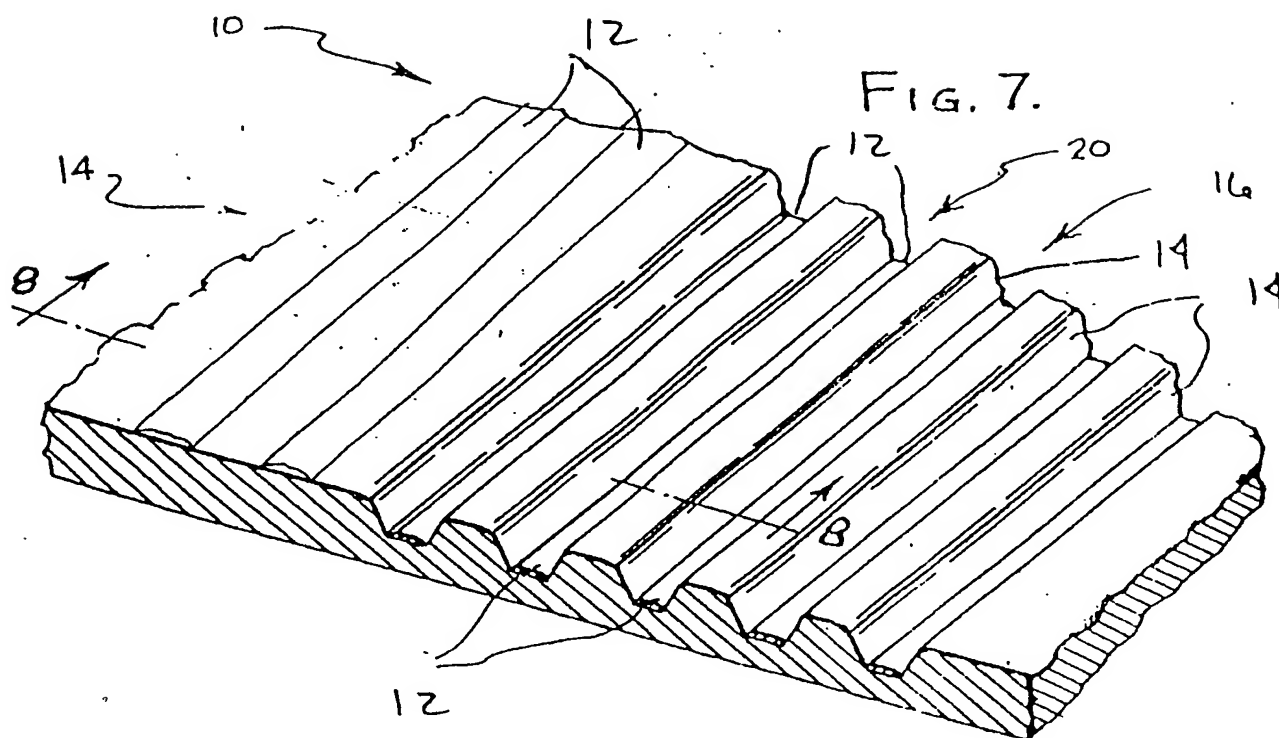
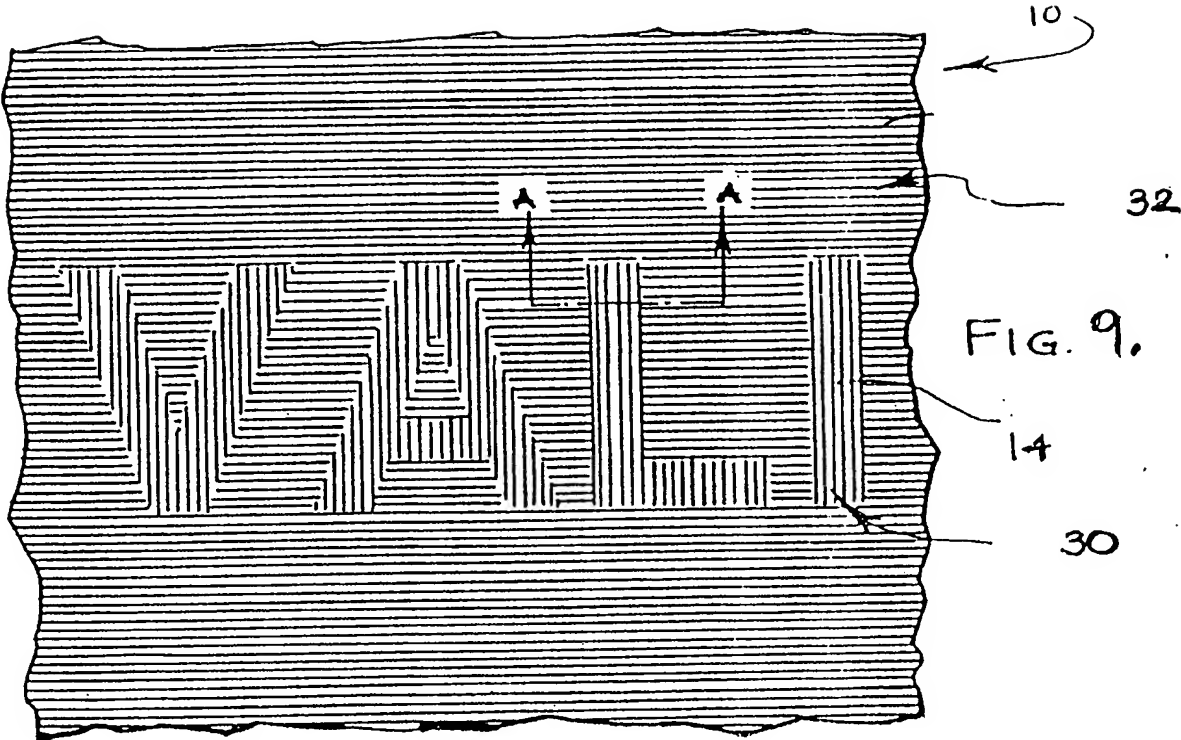


FIG. 8.

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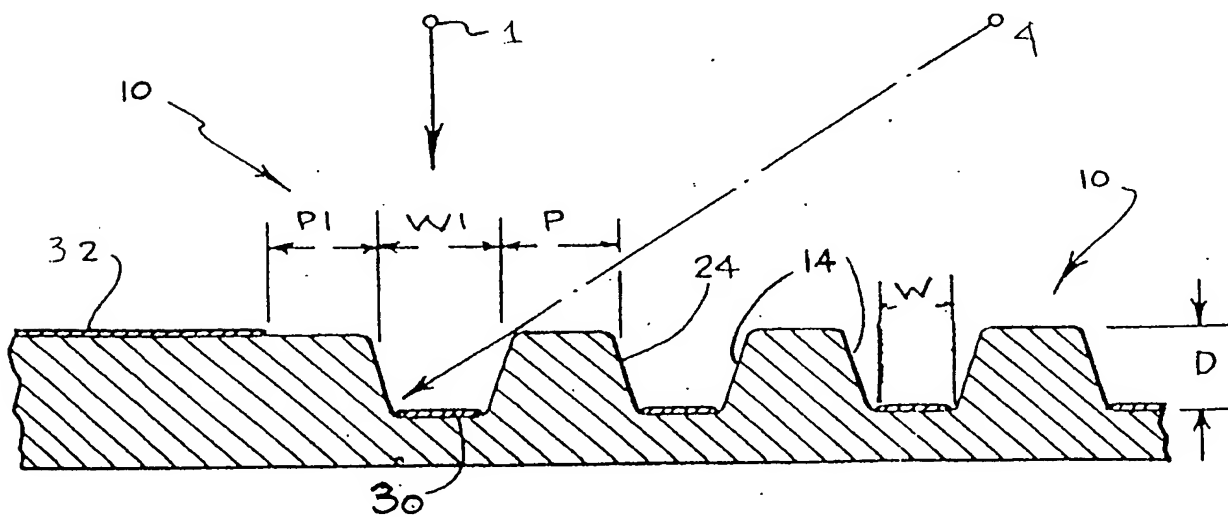
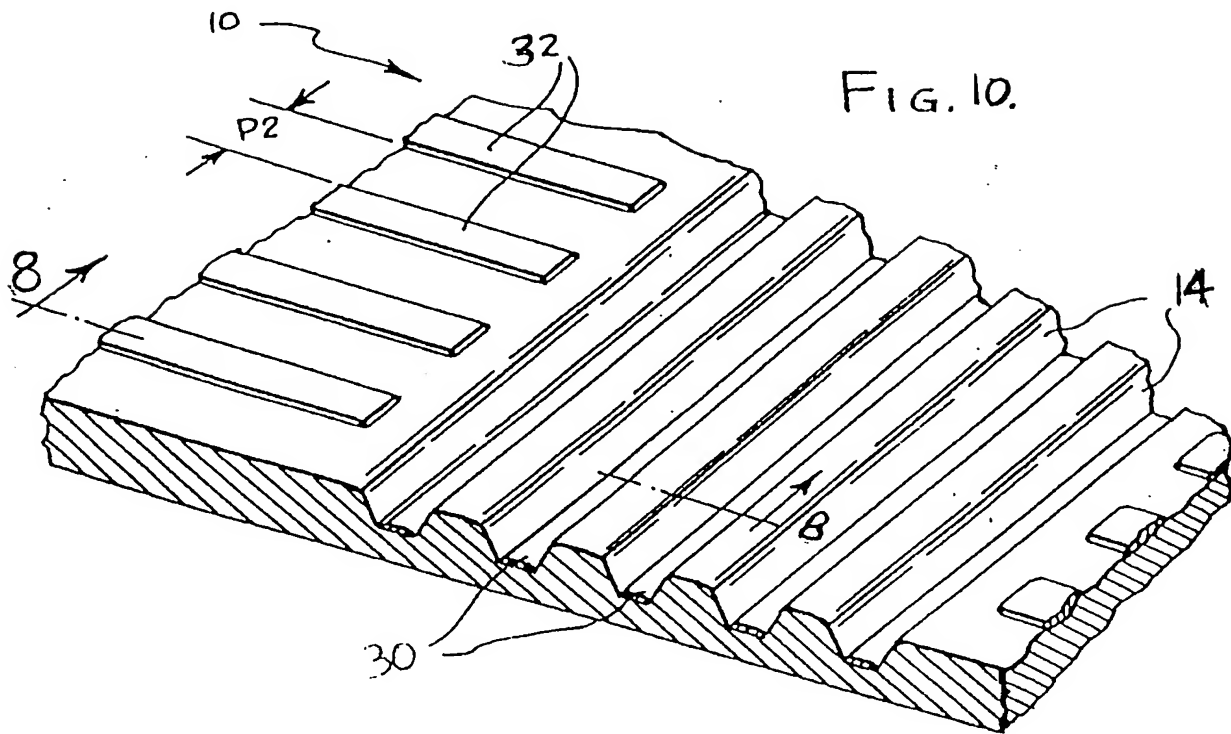


FIG. 11.

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